

State of Michigan (SOM)

Project Estimating Guide

**A “How To” guide for project schedule estimation,
building a WBS and project budget estimation**

Version 1.0

July 2013



Department of Technology, Management & Budget

Preface

The purpose of this guide is to provide guidance and detail on the practice of project estimating for scheduling and budgeting purposes utilizing the work breakdown structure as the basic tool. This guide also includes the practice overview, best practices, activities, key terms and references.

The intended audience is those individuals who have had limited exposure to, or would like a refresher for, basic project management.

Acknowledgements

The EPMO Guidebook Team owes a large debt to the Center for Disease Control and Prevention (CDC) and Daniel Vitek, MBA, PMP consultant to CDC for permitting us the free use of the CDC Unified Process Practices Guide: Project Estimating Guide, UP Version 2007 as a basis for this document. This document and other CDC Project Management Practices can be found at <http://www2a.cdc.gov/cdcup/>

The State of Michigan would like to thank the following individuals and organizations that made this initial version possible. Without their collaboration and information sharing, this would not have been achieved.

INITIAL RELEASE (July 2013)	
DTMB Senior Project Manager	Kristen Furseth
DTMB Enterprise Portfolio Management Office	Pam Arnold, Ward Beauchamp, Kristen Furseth, Virginia Hambric, Lupe Manty, Diana Quintero, Cindy Turben

The following information is used to control and track modifications to this document.

Revision Date	Author(s)	Section(s)	Summary

Table of Contents

Chapter 1.0 Introduction	1
Chapter 2.0 Project Estimating for Schedule and Resources	3
Chapter 3.0 How to Build a Work Breakdown Structure (WBS)	12
Chapter 4.0 Estimating the Project Budget.....	16
References.....	20
Project Management Key Terms, Definitions and Acronyms	20

Chapter 1.0 Introduction

Establishing realistic estimates for project schedules, budgets, resources, etc. is one of the most challenging aspects of planning a project. Project managers are constantly challenged to provide timely, accurate and updated project estimates. Often these estimates are for work that project managers may have little experience or familiarity with or to achieve a project goal that has never before been accomplished. The practice of project estimating answers key questions, such as those below, that may impact how estimating will be performed for the project:

- What is the work to be estimated?
- How will the estimate be determined?
- When will the work be accomplished?
- Who will do the work?
- Do interdependencies exist between tasks and/or other projects that may impact estimates?
- Are there any assumptions to guide the estimating?

Project estimating is an activity that occurs throughout the life of a project. In the early stages of a project's life cycle, such as the Initiation Phase, less information is known about the required work to complete the project. These early estimates often have little time invested in determining the estimate and are often "ball-park" estimates. Early estimates are often rough and may eventually have a variance greater than +/- 100%, or more, from the actual effort required to complete the work.

This guide explains how to build a Work Breakdown Structure (WBS). A WBS is a project management tool that assists in gathering, coordinating and rolling-up the estimating information and data to formulate a timeline, resource requirements and a budget. The Project Management Institute's Project Management Body of Knowledge (PMBOK) defines the WBS as a deliverable-oriented hierarchical decomposition of the work to be executed by the project team. In simpler terms, the WBS organizes and defines 100% of the scope of the project work to be accomplished and is organized in a manner that visibly shows how the work (activities and tasks) relate to each other and to the project's deliverables and milestones.

As the project progresses, more information regarding details of the project and the type of work required becomes available. More detailed information often changes initial perceptions

of expected work effort. As a result, initial project estimates should be reevaluated repeatedly throughout the project's life. It is best to incorporate project schedule reviews as a task in the work breakdown schedule. Revised estimates become more accurate as greater detail becomes known about the work to be accomplished. If necessary, updates to the project schedule and other project documentation should be made to reflect major changes in estimates. These changes should then be communicated to appropriate project stakeholders and, if dramatic enough, may require a change request against the project.

Chapter 2.0 Project Estimating for Schedule and Resources

Purpose

The purpose of this chapter is to provide guidance on the practice of project estimating for scheduling and resources and to describe the practice overview, best practices, key activities, and to provide a helpful checklist.

Delivering results within estimated time, cost and quality parameters is critical to project success. In the effort to obtain reasonably accurate estimates the importance of clearly specified, detailed requirements cannot be overstated. This is one of the most important factors in obtaining an accurate estimate. Another important factor to achieving estimating success is to understand the project team's capability to deliver quality work within their working environment. Environment, risks, resource capabilities and project sponsors' priorities are just some of the factors that influence how estimates are determined.

Estimation Techniques

- **Top-Down Estimating** – This technique often estimates large, high-level, chunks of work, usually at the feature or function level. This method is often performed in the early stages of a project before detailed information about the project work is known. This estimation technique provides more of a “ball-park” estimate and is used only to provide an early perspective into the amount of potential project work. Later, as work is decomposed into smaller, more manageable pieces, different estimating techniques are used and estimates often vary drastically from the initial top-down estimate.
- **Bottom-Up Estimating** – This technique often estimates detailed pieces of work, and those estimates are then aggregated into a total estimate for the entire project.
- **Analogous Estimating** – This technique uses expert judgment and historical information of similar activities as the basis for estimating future schedule activity.
- **Parametric Estimating** – This technique uses independent variables to help estimate expected project work. These independent variables may be feature definitions, design or specification documents, or any other variables that describes the scope or type of project work.

- **Three-Point Estimating** – This technique uses a mathematical formula to determine a weighted average of three types of estimates and uses the formula $(Estimate = [Optimistic + [4 * Most Likely] + Pessimistic] / 6)$ to calculate a weighted average estimate. This method is also referred to as the Program Evaluation and Review Technique (PERT).
 - 1) *Optimistic* – An estimate that is based on the best-case scenario for work completion, such as low risk, small chance of risk occurring and low impact.
 - 2) *Most likely* – An estimate that, given the resources available to do the work, is the most realistically expected.
 - 3) *Pessimistic* – An estimate that is based on the worst-case scenario for work completion such as high risk, greater chance of risk occurring and high impact.

Example: Obtain three different estimates from three different people who have worked on a particular activity. Average their three estimates individually to obtain their average estimate, and then average those three average estimates to determine the overall estimate to be used in the schedule. This might look like this:

Estimator	Best Case	Most Likely	Worst Case	PERT Estimate
Cathy	88hrs	96hrs	120hrs	101hrs
Bob	120hrs	136hrs	176hrs	144hrs
Tyrone	72hrs	96hrs	104hrs	91hrs
Average Estimate =				112hrs

Estimating Example 1

- **What-If Analysis** – This technique is used to evaluate the effects of changing selected factors within the project schedule such as resources, scope and quality to determine what effects those changes may have on the outcome of the project.

Example: Duration for a coding activity estimate is 240 hours utilizing 4 full time coders. What if the activity utilized 5 full-time and 1 part-time coder? The duration estimate would be 186 hours. What if 6 full-time coders were used? The duration would be 176 hours. Reminder: adding more resources doesn't necessary shorten task duration; it all depends on the tasks and other dependencies.

Estimating Process

The first step in the process of project estimation is to build a base of activities and resources

by building a Work Breakdown Structure (WBS).

In general, the following steps are utilized to build a WBS:

1. Define the planned work by breaking down the scope and work deliverables into schedule activities
2. Sequence schedule activities in the order which they will be performed
3. Further breakdown the activities into the actual tasks required to complete each activity
4. Sequence the tasks in the order which they need to be performed
5. Identify resources needed to complete the work. You can use virtual resources for this purpose, if need be.
6. The project team needs to agree upon how to calculate the timeline by work effort, duration or both.
 - a. **Work Effort** – the amount of time to complete the specific task only, i.e. the amount of time required from start to finish with no other interruptions (other commitments, work, meetings, etc.)
 - b. **Duration** – The amount of time to complete a specific task given other commitments, such as other work assignments or vacations.
7. The project team needs to agree upon a common unit of measure for estimating (hours or days) and agree to a standard number of work hours in a day (usually 6.5 hours.)
8. Estimate the level of effort (hours) required to complete the work utilizing the available resources
9. Develop a project schedule. Ensure that any adjustments are made to the sequence of activities that account for resource availability. If an adjustment is necessary and not accounted for in the WBS then the estimated project schedule may be incorrect.
10. Control the schedule by identifying, monitoring and influencing factors that cause schedule change

Inputs into estimates come from a variety of sources, but usually comes from the individuals (Subject Matter Experts and those who likely will be doing the work) most familiar with the type of work needing to be estimated. The practice of estimating uses information from various sources, such as historical data/past similar projects (see example 1), scheduled activities, project scope, resource requirements and availability, dependencies outside of the project, etc. to compile as accurate an estimate as possible with the information available ***at the time of the estimate.***

Estimating techniques always involve assumptions and guesses. Thus, it is important not to rely on solely one source for any particular estimate. It is good practice to obtain estimates from multiple sources and, if possible, utilize different estimating techniques.

Regardless of which estimating techniques are used, one major difficulty that must be overcome is the fear that some people may have of providing an incorrect estimate. This is normal and it is usually beneficial to address this upfront, before the estimating activities commence. Identifying and quantifying the assumptions, constraints and risks can assist in easing any fears.

Another difficulty to overcome may be the over-analyzing of the assumptions and factors that are used to derive the estimates. Both of these difficulties can be paralyzing to project progress. Should these occur, it is best to communicate to those developing the estimate that while any estimate is better than no estimate at all, it is important to be as accurate as possible with the information available at that time.

Incorporating Risk

“To pad or not to pad”, that is the question. It is human nature to pad estimates due to the lack of current available information and the fear of being chastised for being incorrect. Some individuals may pad their estimates to cover any possible risk rather than recognizing and quantifying individual risks into the estimate. In Project Management, the term ‘contingency’ is used to denote the time or money assessed to the estimate to account for risks that may or may not occur.

Risk is a critical factor when estimating time, cost and budget. Usually a detailed risk assessment is conducted later in the planning process, after the preliminary WBS had been developed. However, common risks such as those below need to be taken into account in the initial estimate.

- **Project Team and Resources** – How familiar are the personnel resources with the work required? Have they done similar work before? Has this team worked together before? Is their working environment (managers, co-workers, etc.) conducive and supportive to working on the project? Are the resources available for the required time?

- **Scope** – It is very important that all the stakeholders including executives, managers of the project resources and others have a common and agreed to understanding of the project scope, deliverables, milestones, resource requirements and involvement given the project's priority level within the organization. This understanding and agreement is accomplished with a Project Charter.
- **Business/Operating Environment** – This is a risk for those who operate in one or more of the following: a competitive, fast paced, fluid environment and/or with a project that relies on specific technology. Technology changes so fast and can be revolutionary and not evolutionary. Does the project leverage a current law that may be changed? Does the project need to be implemented to support a future law or a change in business rules and/or processes? Will the infrastructure technology be fully supported; for how long; and at what cost? Are new technology applications quickly becoming mainstream that may render the technology utilized in the project obsolete (e.g., thick client to thin client to apps to mobile apps).

Not every risk needs quantitative analysis. Only those risks with significant impact need to be highly quantified when determining certain costs and time objectives for the project.

Quick Tip: Use simple quantitative calculations to account for risks in the schedule estimate:

1. Identify the risks – e.g., late delivery of material ordered
2. Estimate the percentage of chance that risk is to occur: e.g., 50 %
3. If they should occur, what the time/cost impact would be to that task or activity: 4 business days
4. Multiple the chance percentage by the impact, number of days, for the contingency to be added to that task or activity, i.e. $.5 \times 4 = 2$ days so 2 days is added on a contingency line to that task. Document in the notes the risk and the calculation.

For a more in depth explanation on risks and how to quantify schedule and budget estimates, see the Project Management Plan at <http://www.michigan.gov/suite/0,4674,7-245-60232---,00.html>

Assumptions and Constraints:

The project team needs to discuss and agree to the assumptions and constraints being used to derive the estimates. These assumptions and constraints should be documented and

presented to the project sponsor and appropriate stakeholders when presenting the WBS, project schedule, resources and budget. This facilitates an understanding of how the estimates were derived and what factors were involved. It can also assist with identifying areas of misunderstanding between and among the project team, project sponsor and project stakeholders. As more detail is acquired about the expected project work, it becomes easier to more accurately refine the effort required to complete the work.

The following is an example of areas that should be considered when identifying and discussing assumptions, constraints and risks.

- Scope
- Schedule
- Hardware
- Resources
- Licenses for all required software (development and production)
- Project sponsorship
- Customer availability (requirements, testing)
- Software technologies
- Vendors
- Partners and business relationships
- Timeframe/deadline (deadline provided)
- Maintenance included/not included
- Funding
- Skill levels of resources
- Dependencies on other software/application(s)
- Legal (mandated by State or Federal Law)
- Policies and procedures
- Environmental compatibility
- Network availability (bandwidth)
- Add more as identified

Using Historical Data

One of the more ideal ways of estimating is to estimate how long a task will take based on experience implementing similar tasks in the past. Using this method, estimates are based on actual results from similar tasks of previous projects. However, projects are often unique and work performed to successfully complete one project may not necessarily apply to other projects.

This is an example on how to identify and utilize historical information. The highlighted green rows indicate the tasks that would need to be adjusted in a WBS for a similar task and/or project scope.

Chapter 2.0

Task Name	% Complete	Estimated Work Effort	Actual Work Effort	Start	Finish	Predecessors	Resource Names
Batch 2 Migration - W. Saginaw (300-400 Stations) 10/24/08	100%	82.75 days	1,147.48 hrs	Fri 7/18/08	Fri 11/7/08		
Preparation and Notification	100%	41.5 days	658.48 hrs	Fri 7/18/08	Tue 9/16/08		
Check Router Upgrade is completed	100%	4 hrs	4 hrs	Fri 7/18/08	Fri 7/18/08		
Pre Notification - Request Agencies' Black-Out Dates	100%	1 hr	1 hr	Wed 7/30/08	Wed 7/30/08		Consultants
Review black-out dates and validate cut-over week-end	100%	1 hr	2 hrs	Wed 8/6/08	Wed 8/6/08	5FS+5 days	Tom, Ned
Create & Submit DIT SMC	100%	2 hrs	2 hrs	Wed 8/6/08	Wed 8/6/08	6	Tom
Create & Submit Remedy Ticket for merges	100%	1 hr	1 hr	Wed 8/6/08	Wed 8/6/08	6	Tom
Generate Remedy ticket for IP connectivity, IP addresses, etc.	100%	2 hrs	2 hrs	Wed 8/6/08	Wed 8/6/08	6	Ned
DIT SMC approved by ECB	100%	0 days	0 hrs	Wed 8/13/08	Wed 8/13/08	8FS+1 wk	Tom
Notification to Agency Telephone Coord., CSD's, IO's, DIT SMC	100%	0.5 hrs	1 hr	Wed 7/30/08	Wed 7/30/08	5FS+2 wks	Kim, Joe
Validate Notification emails list	100%	2 hrs	2 hrs	Wed 7/30/08	Wed 7/30/08	11	Consultants, Kristen
Activate process for capturing new work orders	100%	0.13 days	1 hr	Wed 8/13/08	Wed 8/13/08	11	Joann
Implement Freeze - 4 wks before cut-over -	100%	0 days	0 hrs	Fri 8/15/08	Fri 8/15/08	11SS+1 day	Joann
Process Agency work-orders before pulling reports	100%	40 hrs	40 hrs	Fri 8/8/08	Thu 8/14/08		Joann
Validate that all completed EPN work orders are closed	100%	40 hrs	40 hrs	Fri 8/8/08	Thu 8/14/08		Joe
Review Agency involvement	100%	3.38 days	70 hrs	Wed 7/30/08	Mon 8/4/08		
Review Call Center ACD applications for compatibility with Telecom versions	100%	4 hrs	16 hrs	Wed 7/30/08	Wed 7/30/08	11	Pat,Kathy,Kim,Sue
Arrange for special testing	100%	8 hrs	32 hrs	Wed 7/30/08	Thu 7/31/08	18	Sue,Kim,Kathy,Pat
Review outstanding trouble tickets	100%	2 hrs	2 hrs	Thu 7/31/08	Thu 7/31/08	19	Agency
Report any trouble ticket issues to coordinator	100%	4 hrs	16 hrs	Thu 7/31/08	Fri 8/1/08	20	Sue,Kim,Kathy,Pat
Identify special circuits	100%	1 hr	4 hrs	Fri 8/1/08	Fri 8/1/08	21	Sue,Kim,Kathy,Pat
Report special circuits to Neville	100%	0 days	0 hrs	Mon 8/4/08	Mon 8/4/08	22FS+1 day	Ned

Historical Data Example 1

Project Estimation Working Meeting

A good process for obtaining estimates is to conduct project estimation working meetings. These meetings give the project manager the opportunity to gather those individuals involved in the estimation process in one location where estimates can quickly be agreed upon with input from all project/functional areas. This also facilitates cross-communication regarding activities that may span multiple business units, departments, and/or teams.

The goal of an estimation workshop is to:

- Estimate the work effort for each schedule activity and task
- Assign each activity and task estimate a level of risk (high, medium or low)
- Document any estimate constraints or assumptions
- Document any dependencies on external project activities
- Review the project timeline as a whole and document any newly identified risks

Ideally, the participants of the project estimation meeting would be the individuals who will be performing the project work. However, if these individuals are not available, the functional team leaders/managers and/or SME(s) could participate in their place. For larger projects it may be necessary to conduct multiple workshops to estimate all of the project's work.

Best Practices

The following best practices are recommended for Project Estimating:

- **Expectations** – Set expectations regarding estimates based on the information available to make those estimates. At the beginning of a project when information is less available, estimates are often less accurate. Later, as more information becomes available, estimates become more accurate.
- **Multiple Estimates** – For the best possible overall estimate, use multiple estimating techniques and different sources for each estimate.
- **History** – Maintaining and analyzing the historical accuracy of related estimates may help make future estimates more accurate.
- **Review** – Do a sanity check on the estimates. Have others review them as well.
- **Document** – Document all assumptions and the estimating techniques used to derive the project estimates.

Checklist

1. Project Manager or project team decides on how estimates will be determined and documented.
2. Project Manager or project team decides on the common units of measurement (hours or days).
3. Project Manager, with stakeholder agreement, decides on the number of hours to use for a working day. The State of Michigan normally uses 6.5 hours for an 8 hour day.
4. Verify that the estimates for the scheduled activities and tasks are realistic.
5. Verify that the estimates take into account any interdependencies that may exist between tasks, other projects and outside factors.
6. Ensure that the estimates have been obtained from multiple sources and aggregated using the previously agreed upon techniques.
7. Ensure that the project estimates include schedule, resources, risks and budget.
8. All assumptions made and used in the estimating process must be documented.
9. The estimating technique(s), assumptions and risks must be communicated and agreed to by the Project Sponsor/Stakeholders.
10. Project Sponsor/Stakeholders agree with how the estimates will be monitored, managed and communicated.

Chapter 3.0 How to Build a Work Breakdown Structure (WBS)

Purpose

The purpose of this chapter is to provide guidance on building a Work Breakdown Structure (WBS) and to describe the practice overview, techniques, activities and best practices.

Practice Overview

A Work Breakdown Structure is a basic project management tool that organizes and defines 100% of the scope of the project work to be accomplished and is organized in a manner that visibly shows how the work (activities and tasks) relates to each other and to the project deliverables and milestones. The Project Management Institute's Project Management Body of Knowledge (PMBOK) defines the WBS as a deliverable-oriented hierarchical decomposition of the work to be executed by the project team. In simpler terms, building a WBS assists the project team in understanding how the work will be done and is utilized to derive estimates for the project schedule and budget.

There is a common misconception that developing a WBS is an easy task and can be done quickly. It is not difficult to build a WBS however, sufficient time is necessary to build a WBS that will be useful in planning, estimating, managing resources and for controlling and monitoring a project. The amount of time required to build a WBS depends heavily on the experience of the project manager, project team and the type and complexity of the project.

Developing a WBS is an activity that takes place early in the project life cycle with updates and refinements made throughout the project's life, as necessary.

Techniques

Determining how much detail is needed isn't easy to discern. Even experienced project managers often have difficulty deciding when the WBS is at an appropriate detailed level for the project type. For many projects, a general rule of thumb is to include a task line for any task that will take at least 12 hours (equivalent to two business days) or longer in work effort. Any task in the critical path, regardless of its duration, must be included in the WBS for tracking purposes.

Work needs to be described in sufficient detail to support accurate planning and meaningful tracking. However, not in so much detail that time is not being used effectively in developing and maintaining the WBS.

The WBS should be structured, at its lowest level, into elements that can be:

- Managed
- Estimated
- Measured

These three important questions can assist in determining if an activity or task has sufficient detail:

- 1) Can you accurately estimate the resources needed to perform the activity/task?
- 2) Can you accurately estimate how long the activity/tasks will take to perform?
- 3) If you were to assign an activity or task to someone a few months after the WBS was developed, will they understand exactly what to do?

If the answer to any of these questions is “no”, then it is necessary to further break the work down into finer detail.

A WBS makes the relationship of work packages understandable by decomposing larger work into smaller, more manageable components that outline the work needing to be accomplished for the project to succeed. The process of decomposing project work into a WBS involves:

- Identifying project deliverables
- Identifying work related to project deliverables (work packages)
- Developing a high-level WBS based on the above information (activity level)
- Decomposing the high-level WBS into tasks and/or activities

The resulting WBS can take a number of forms such as:

- Using major project deliverables and/or subprojects as the first level of the WBS
- Using the phases of the project life cycle as the first level of the WBS with the project deliverables used as the second level
- Using a combination of phases and project deliverables within each branch of the WBS

Developing the Work Breakdown Structure

The process of developing a WBS is primarily concerned with the actions necessary to define, organize and subdivide the work required to meet project goals to a task level. The WBS is usually drafted jointly by the project manager, the project team, and appropriate stakeholders. If possible, it is best to start out with a template from a similar project.

A good WBS is not necessarily lengthy. The content of the WBS will vary depending upon the complexity of the project. The size of and time invested to develop a WBS should be balanced with the

size and complexity of the overall project. Large, more complex projects justify a significant effort in developing a comprehensive WBS.

The WBS is a living document that should be updated continually throughout the life of the project. As changes occur and more information is received, that information can be used to 'firm up' previous estimates.

Activity

Steps to building a WBS:

- 1) Define the scope of the project
- 2) Define the project deliverables
- 3) Decompose the project deliverables into work packages (activity level) to a level that can be scheduled, cost estimated, monitored and controlled.
- 4) Decompose the work packages into tasks which are the separate tasks that are required to accomplish the work package/activity. In some instances, it may necessary to define sub-tasks that are required to complete a task. These sub-tasks are the lowest level of a WBS, and are used to define the work, estimate work effort, assign resources, identify dependencies and build a schedule.
- 5) From the task level, build up with the work estimates, durations, resources and other project components.
- 6) From the WBS derive the overall timeline, budget estimates, resource requirements, critical path and any outside dependencies that are beyond the control of the project team.

Task Name	
EPN 2 & 5 Merge-750 stations 3-31-11	Project Title
Preparation and Notification	Activity Level
Pull New Switch & Billing report for station count	Task Level
Pre Notification - Request Agencies' Black-Out Dates	Task Level
Review black- out dates and validate cut-over week-end	Task Level
Notification to Agency Telephone Coord., CSD's, IO's, DIT SMC	Task Level
Execute Cutover	Activity Level
Implement Cut-over	Task Level
X port Stations to Capitol	Task Level
Install/Test I Avaya Hardware at required locations	Task Level
Re-cable to Capital	Sub-task Level
Steer extensions in GT to Capital	Sub-task Level
Steer extensions on the Capital Switch	Sub-task Level
Build Video Bridge extensions live - if necessary	Sub-task Level
TTI extensions (un X ports)	Sub-task Level
Validate moves	Task Level

WBS Example 1

Best Practices

The following best practices are recommended for Work Breakdown Structure development:

- Jointly Developed – The WBS should be drafted jointly by the project manager, the project team and stakeholders.
- Product Elements – Do not include elements that are not product related. A WBS addresses system requirements, not system functions or costs.
- No Acronyms – Use actual system names and nomenclature to avoid confusion.
- Continually Review– make it a part of the weekly project team meeting to review the WBS, looking for any changes, delays and/or opportunities that may have impacted the critical path and/or the WBS.
- Make Updates – As the project environment changes, updates in the form of change requests should reflect any changes to the WBS.
- Review – Review the completed WBS with the customer before creating a schedule.

Quick tips

Task Titles: There is often pressure to shorten task titles in order to keep the WBS visually pleasing; however, it is important to title activities and tasks with enough detail so that everyone will understand what the activity/task means six months later. More task information can be added to the “notes” tab of that task.

Chapter 4.0 Estimating the Project Budget

Purpose

The purpose of this chapter is to provide additional guidance and detail on the practice of budget estimating for projects. This is accomplished through practice overview and activities.

Practice Overview

Establishing realistic resource estimates for project budgets is one of the most challenging aspects of planning a project. When you move into the planning stage of your project, you're ready to create your detailed budget estimate. The budget estimate is derived from the Work Breakdown Structure (WBS), which needs to be as complete as possible in order to produce the best estimates. The work estimate column - which could be titled Duration or Work - must be validated by the project manager to ensure that it is an estimate for the actual work to be conducted and not the duration of the time necessary for the assigned person to complete the work given their other work commitments. If the work is, in fact, a duration estimate, then an additional column labeled 'Work' will need to be added to the WBS and the project team will need to estimate the work effort for each task. Budget estimating cannot begin until the work effort estimates have been established.

The practice of budget estimating answers key questions that may impact how estimating will be performed for the project. Some examples of these questions are:

- Who is doing the work?
- What is the hourly rate of pay for each person on the project?
and/or
- What is the average hourly rate of pay for the people on the project with a particular job title or level?
- Will any direct costs or indirect costs for materials, equipment, contractual services, etc. be involved in the project?
- Are any assumptions being used to guide this estimating process?

Estimation Techniques

Labor Costs: Utilizing the WBS at its lowest level, the task level, labor costs can be calculated from the work estimate column for each task. These labor costs are then rolled up to a total for each activity, phase, by person and finally, into the labor total for the entire project.

Direct labor costs can be estimated by using the following definitions for salary either separately or in combination.

- The actual fully loaded pay rate of each person on the project. A 'fully loaded' pay rate includes the cost of benefits.
- The average pay rate for people with a similar job function or at the same personnel level. This average can be an average internal to the State, if known, or it can be an industry average for the job classification.

There may be times when both methods are used. For example, in one area the salaries are known but in another area they are not known, so an industry average is used instead.

Once the salary for the personnel resources have been established, a pay rate per hour is calculated. This is then multiplied by the number of hours in the work estimate column to derive the cost per task. These costs are then rolled up to the total labor cost for the project.

Outline Number	Task Name	Work	Start	Finish	Predecessors	Resource Names
1	Prepare for Migration	40 hrs.	Tue 5/14/13	Mon 5/20/13		
1.1	Identify Extensions specific to this move	3 hrs.	Wed 5/15/13	Wed 5/15/13		Joann
1.2	Identify Application specific to this move	6 hrs.	Thu 5/16/13	Thu 5/16/13		Joann, Kim
1.3	Re-design vectors	16 hrs.	Thu 5/16/13	Mon 5/20/13	2,3	Lori

Estimating Project Budget Example 1

Cost basis has been determined that it is best to use a full loaded average rate of \$65 per hour. This figure was received from the Human Resources (HR) area.

Cost for task 1.1 - \$195

Cost for task 1.2 - \$390

Cost for task 1.3 - \$1,040

Total for labor for project - \$1,625

Project Management Costs: Project management tasks should be identified and listed by task in the WBS. If not, there should be a consideration of adding an Indirect Cost Category in the budget that will take into account the project management costs for the project. Typically, project management costs are 10-20% of the total project budget depending on the complexity of the project and the number of

stakeholders.

Contractual Services can also be estimated utilizing the work effort hours multiplied by the average contractual rate for services required. Consult with the State's Procurement Office for a table of the actual or approved average contractual services rates.

It is very important to document both how the labor costs are calculated and any assumptions used when calculating pay rates and/or work hours.

Direct Costs: Utilizing the WBS at the task level, identify the materials, equipment, and other non-personnel resources that are needed for the project. This is best accomplished with the project team reviewing the WBS and documenting any material and/or equipment that needs to be purchased, leased or otherwise used that has an associated cost. Consult with the State's Procurement Office, administrative staff and the Finance Services Division to determine the costs of these resources.

Costing calculations can be broken out by personnel, pay rate, activity and phase. Use the calculation that makes sense and is easy to follow for the type of project being estimated.

Budget Estimate Documentation Example:

Cost Category	Costing Calculations	Total Cost
Direct Labor	Activity 1L25 hrs. x \$65/hr.	\$1625
Project Management	\$1625 x 10%	\$162.5
Materials	N/A	N/A
Subcontract – ATT service order	\$200 per contract	\$200
Total Project Costs		\$1987.5

Estimating Project Budget Example 2

Notes: Used fully loaded average hourly cost figures received from HR for State pay rates.

Quick Tip

When building the WBS, include two columns for time. Use one column named "Duration" to capture the total time required given other responsibilities and priorities for a resource(s) to complete a task. Use another column named "Work" to capture the actual time required to complete the task if it is started and finished without interruption (also known as work effort).

The "Duration" column is used for project scheduling, setting predecessor tasks and for the project timeline. The "Work" column is used to produce resource costing for the project budget and if

necessary, to charge the resource costs to the customer.

For example:

Outline Number	Task Name	Work	Duration	Start	Finish	Predecessors	Resource Names
1	Prepare for Migration	40 hrs	10 days	Tue 5/14/13	Mon 5/20/13		
1.1	Identify Extensions specific to this move	3 hrs	2 days	Wed 5/15/13	Wed 5/15/13		Joann
1.2	Identify Application specific to this move	6 hrs	3 days	Thu 5/16/13	Thu 5/16/13		Joann, Kim
1.3	Re-design vectors	16 hrs	5 days	Thu 5/16/13	Mon 5/20/13	2,3	Lori

Estimating Project Budget Example 3

References

1. Kerzner, Harold PhD, *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*, 6th edition, John Wiley & Sons, 1998
2. Vitek, Daniel, *CDC Unified Process Practices Guide: Project Estimating Guide*, UP Version, 2007
3. Portny, Stanley E., *Project Management For Dummies*, IDG Books Worldwide, INC, 2001
4. State of Michigan Project Management Methodology: <http://www.michigan.gov/suite>

Related Link

[Project Management Key Terms, Definitions, and Acronyms](#)